

REMARKS/ARGUMENTS

Claims 1-32 and 34-59 remain in this application. Claims 1-23, 25, 27, 34-35, and 37-56 have been withdrawn. Claims 24, 26, 28-29, 32, 34-36, 57, and 58 have been finally rejected. Claims 24, 26, and 57 have been amended to clarify that the photoinitiator system is for a cationically polymerizable resin.

I. SPECIES ELECTION

Applicant acknowledges withdrawal of Claims 30 and 31 as being drawn to a non-elected species. Applicant, however, notes that Claims 30 and 31 are directed to a silicon-containing epoxy resin, and that is still an epoxy resin that comes within the definition of the species.

II. 103 REJECTIONS BASED ON BERNER

On page 3 of the Office Action, the Examiner finally rejected Claims 24, 26, 28-29, 32, 33, 36, 57, and 58 as being obvious and therefore unpatentable under 35 U.S.C. § 103 based on U.S. Patent No. 4,560,709 to Berner et al. ("the Berner Patent"). Applicant respectfully traverses the rejection.

To establish a prima facie case of obviousness, three basic criteria must be met. First, each and every claim limitation must be taught or suggested by the prior art. Second, there must be some suggestion or motivation to one skilled in the art to modify the references or to combine their teachings. Lastly, there must be a reasonable expectation of success in combining the references to achieve the claimed combination. Equally important, to support combining references, evidence of a suggestion, teaching or motivation to combine must be **clear and particular**, and this requirement for clear and particular evidence is not met by broad conclusory statements about the teaching of the references. In re Dembiczak, U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). There must be particular evidence from the prior art as to the reason the skilled

artisan, with no knowledge of the claimed invention, **would have selected these components for combination in the manner claimed.** In re Kotzab, 55 U.S.P.Q.2d 1313, 13717 (Fed. Cir. 2000). Applying these principles to the present application, it is clear that a prima facie case of obviousness had not been made.

The present invention is directed to a three-component photoinitiator system for a cationically polymerizable resin comprising (a) an iodonium salt; (b) a visible light sensitizer that is a ketone selected from the group consisting of alpha-diketones, xanthene dyes, fluorone dyes, fluorescein dyes, and combinations thereof; and (c) an electron donor comprising an alkoxy substituted anthracene.

The Berner Patent is directed to a photopolymerizable mixture. An aromatic iodonium salt is used as a polymerization catalyst (col. 2, line 3). An aromatic carbonyl (ketone of formula I, II, or III) is the co-catalyst (col. 2 lines 3-55). In addition, Berner teaches, the mixture can include a laundry list of other additives, including a photosensitizer. The Berner Patent states:

Examples of such additives are pigments, dyes, fillers and reinforcing materials, glass fibres and other fibres, flameproofing agents, antistatic agents or levelling assistants. **Further examples are photosensitisers, which shift the spectral sensitivity of the photopolymerisable mixtures into specific ranges, for example perylene, derivatives of anthracene and of thioxanthone or organic dyes. . . .** Further examples of additives are heat stabilisers which increase the storage stability of the photopolymerisable mixtures, for example specific nitriles, amides or sulfoxides. Further examples are antioxidants and light stabilisers, which are intended to stabilise the cured compositions against ageing.

See column 6, lines 53-66 (emphasis added). The Berner Patent continues:

If short-wave light is excluded, the mixtures according to the invention can be stored at room temperature for a long time without undergoing change. Polymerisation of the mixture is effected by irradiation with short-wave light, for example by means of medium-pressure, high-pressure or low-pressure mercury

vapour lamps or by means of superactinic fluorescent tubes, which have an emission spectrum in the range of 250-400 mμ. In the presence of suitable photosensitisers, curing in daylight is also possible. **Such sensitisers are described, for example, in U.S. Pat. No. 3,729,313.** It is not necessary to add any catalyst or other additive to the mixture according to the invention prior to polymerisation. The mixtures are therefore solvent-free one-component systems.

See column 6, line 67 to column 7, line 12 (emphasis added). The examples in the Berner Patent all teach a mixture including an aromatic iodonium salt (Ca1, Ca2), a co-catalyst (Co1, Co2, Co3 etc.), and a photosensitizer, which is either S1 (9,10-diethoxyanthracene) or S2 (perylene).

Referring initially to independent Claims 24, 26, and 57, Berner does not teach or suggest Applicant's claimed three-component photoinitiator system. Instead, the Berner Patent teaches a catalyst/co-catalyst system in conjunction with a single photosensitizer, e.g. an alkoxyanthracene (S1) or perylene (S2). Thus, the Berner Patent does not teach or suggest using a visible light sensitizer in combination with an electron donor which is an alkoxy substituted anthracene. The Berner Patent also does not teach or suggest the particular claimed visible light sensitizer which is a ketone selected from the group consisting of alpha-diketones, xanthene dyes, fluorone dyes, fluorescein dyes, and combinations thereof, in combination with an alkoxyanthracene as claimed by Applicant in Claims 24, 26, and 57.

The Examiner relies on the Smith '313 Patent as providing motivation for arriving at Applicant's unique photoinitiator system. The Smith '313 Patent teaches that diaryliodonium compounds can be used for free-radical polymerization in the presence of a sensitizer. According to the Smith '313 Patent:

Unless a sensitizer is present the diphenyliodonium compounds have not been found to produce free radicals Since each sensitizer tends to have its own characteristic response in the visible and ultraviolet light spectrum, they may be used in

combination to broaden the light response and/or increase the speed. Illustrative sensitizing dyes are those in the following categories: diphenylmethane, xanthane, acridine, methine and polymethine, thiazole, thiazine, azine, aminoketone, porphrin, colored aromatic polycyclic hydrocarbons, p-substituted aminostyryl compounds, and aminotriaryl methanes.

See column 2, lines 26-45. In each of Examples 1-12 of the Smith '313 Patent, one of the sensitizing dyes in Table I (including 2-ethyl-9,10-dimethoxyanthracene in Example 5) is combined with a diphenyl iodonium compound for the free-radical polymerization of an acrylate (pentaerythritol tetraacrylate). In Examples 19-35, one of the other sensitizing dyes in Table III is combined with a diphenyliodonium salts for the free-radical polymerization of an acrylate with polyvinylbutyral as a cross-linker. In Examples 37-47, one of the dyes in Table IV (including 5,10-diethoxy anthracenes in Examples 40 and 41) is combined with the diphenyliodonium compound for the free-radical polymerization of a methacrylate and cellulose acetate butyrate. Examples 48-53 (Table V) and Examples 54-56 (un-numbered Table at column 7) again use a single dye with a diphenyliodonium salt for free-radical polymerization. Thus, all of the examples teach an iodonium compound in conjunction with a single photosensitizer in order to promote free-radical polymerization. While the Smith '313 Patent teaches an iodonium compound in combination with an alkoxyanthracene for the free-radical polymerization system, nowhere does the Smith '313 Patent teach or suggest the photoinitiator from a cationically polymerizable resin comprising a combination of (a) an iodonium salt; (b) a visible light sensitizer that is a ketone selected from the group consisting of alpha-diketones, xanthene dyes, fluorone dyes, fluorescein dyes, and combinations thereof; and (c) an electron donor comprising an alkoxy substituted anthracene as claimed.

The Examiner relies primarily on the Smith '313 Patent's statement that a "combination" of sensitizers can be used to broaden the light response and/or increase speed of the free-radical polymerization. Thus, the Examiner argues that "Smith '313 provides motivation to use an organic dye in combination with a derivative of anthracene." Applicant respectfully disagrees.

As discussed above, the Smith '313 Patent teaches a laundry list of sensitizers in column 2, lines 26-45, and over fifty sensitizers in Tables I, III, IV, and V to promote the free-radical polymerization of an iodonium salt system. Thus, what would motivate one skilled in the art to pick and choose from the laundry list of various sensitizers in the Smith '313 Patent to arrive at the claimed combination? The absence of a motivation to select the particular claimed combination (iodonium salt, visible light sensitizer that is a specified ketone, and alkoxyanthracene) is also demonstrated, the Smith '313 Patent does not teach a combination example in the 57 examples! Nor does the Smith '313 Patent teach or suggest how or why such a combination should be made in the context of a cationic polymerization system (as claimed) since the Smith '313 Patent deals exclusively with free-radical polymerization.

Further, when read in light of the Berner Patent, it is clear that the prior art teaches away from the claimed combination. The Berner Patent teaches that "photosensitisers, which shift the spectral sensitivity of the photopolymerisable mixtures into specific ranges, for example perylene, derivatives of anthracene and of thioxanthone or organic dyes. . . ." (column 6, lines 55-60) can be used. Again, there is no teaching or suggestion of the claimed three-component system.

III. 103 REJECTIONS BASED ON OLOFSON

On page 4 of the Office Action, the Examiner finally rejected Claims 24, 26, 28-29, 32-36, 57, and 58 as being obvious and therefore unpatentable under 35 U.S.C. § 103 based on U.S.

Patent No. Olofson et al., U.S. Patent No. 6,706,403 ("the Olofson Patent"). Applicant respectfully traverses the rejection.

The Olofson Patent is directed to a photopolymerizable adhesive for laminating a CRT display. The relevant portion of the Olofson Patent is set forth the below:

The aromatic iodonium complex salts useful in the photopolymerizable compositions of the invention are typically photosensitive only in the ultraviolet spectrum. The complex salts can be sensitized to the near ultraviolet and the visible range of the spectrum by sensitizers for known photolyzable organic halogen compounds in accordance with the teachings of U.S. Pat. No. 3,729,313. Representative sensitizers include, e.g., anthracene, 9-methylanthracene, 2-ethyl-9,10-dimethoxyanthracene, 9,10-diethoxy anthracene, camphorquinone, and 1,3-diphenylisobenzofuran. The sensitizer should preferably be reactive to light in the visible or near ultraviolet region, particularly in implementations where the radiation must pass through a UV-light absorbing glass. Therefore, the sensitizer is preferably reactive to light having a wavelength of greater than 350 nm.

See column 12, lines 26-41. Thus, this passage clearly contemplates the use of one of the compounds as "the sensitizer." Example 2 likewise teaches a diaryliodonium salt (Saracat CD-1012) in conjunction with only a 9,10-diethoxyanthracene. None of the examples, including Example 2, teach or suggest the combining (a) an iodonium salt; (b) a visible light sensitizer that is a ketone selected from the group consisting of alpha-diketones, xanthene dyes, fluorone dyes, fluorescein dyes, and combinations thereof; and (c) an electron donor comprising an alkoxy substituted anthracene as claimed.

As discussed above, the Olofson Patent's reference to the Smith '313 Patent fails to provide a motivation to arrive at the claimed invention. As discussed above, the Smith '313 Patent teaches a laundry list of sensitizers in column 2, lines 26-45, and over fifty sensitizers in Tables I, III, IV, and V to promote the free-radical polymerization of iodonium salt system. In

the 57 examples, the Smith '313 Patent does not teach a combination example. Nor does the Smith '313 Patent teach or suggest how or why such a combination should be made in the context of a cationic polymerization system (as claimed) since the Smith '313 Patent deals exclusively with free-radical polymerization. The Smith '313 Patent certainly does not teach or suggest why one skilled in the art would be motivated arrive at the unique combination of (a) an iodonium salt; (b) a visible light sensitizer that is a ketone selected from the group consisting of alpha-diketones, xanthene dyes, fluorone dyes, fluorescein dyes, and combinations thereof; and (c) an electron donor comprising an alkoxy substituted anthracene as claimed.

For the foregoing reasons, it is respectfully submitted that independent Claims 24, 26, and 57 are not anticipated or made obvious by Berner or Olofson or Smith. Claims 28-29, 32, 34-36, and 58 depend from these claims and are not anticipated or made obvious by Berner or Olofson for the same reasons Claims 24, 26, and 57 are not anticipated or made obvious. Accordingly, a *prima facie* case of obviousness for rejecting claims 24, 26, 28-32, 34-36, and 58 has not been established.

IV. SECONDARY CONSIDERATION

To rebut a prima facie case of obviousness, evidence of unexpected functions and results of the invention may be presented. See *In re May*, 574 F.2d 1082, 197 USPQ 601 (CCPA 1978). In this case, Applicant has submitted the Declaration of Joel D. Oxman in order to show unexpected and superior results compared to that of the prior art. More specifically, Dr. Oxman and his former colleague and co-inventor, Craig Dykstra, performed "Depth of Cure Test Method A" experiments (as set forth in Paragraph 0085-0086 of the patent application) on a filled composition made using a photoinitiator system comprised of an iodonium salt (Tolylcumyliodonium Tetrakis(pentafluorophenyl) Borate (Rhodorsil 2074)), a visible light

ketone sensitizer (camphorquinone (CPQ)) and an alkoxy anthracene electron donor (2-ethyl-9,10-dimethoxy anthracene (EDMO)), and compared the results to similar compositions made in the absence of either CPQ or EDMO.

As set forth in the Dr. Oxman's Declaration, the claimed combination of CPQ and EDMO (formulation F3) resulted in a cure depth of 11.0 mm while that with only CPQ or EDMO resulted in a cure depth of only 4.8 mm or 3.5 mm, respectively. Thus, the combination of the claimed ketone and the alkoxy-substituted anthracene resulted in a cure depth that was unexpectedly deeper than when just the ketone or alkoxy-substituted anthracene was used in the photoinitiator system. Applicant respectfully submits that this evidence of unexpected synergistic properties supports the non-obviousness of the claimed invention to those skilled in the relevant art.

V. CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that the claims are in condition for allowance and eventual issuance. Such action is respectfully requested. Should the Examiner have any further questions or comments which need be addressed in order to obtain allowance, please contact the undersigned attorney at the number listed below.

Acknowledgement of receipt is respectfully requested.

Respectfully submitted,

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